Chapter 8: Challengers

> Mars is the world next door, the nearest planet on which human explorers could safely land. Although it is sometimes as warm as a New England October, Mars is a chilly place, so cold that some of its thin carbon dioxide atmosphere freezes out at the winter pole. There are pink skies, fields of boulders, sand dunes, vast extinct volcanoes that dwarf anything on Earth, a great canyon that would cross most of the United States, sandstorms that sometimes reach half the speed of sound . . . hundreds of ancient river valleys . . . and many other mysteries. (The Mars Declaration, 1987)[1]

National Commission on Space

Late 1984, when the Space Shuttle was operational and Space Station development was underway, seemed an auspicious time to begin charting a course for NASA to follow after Space Station completion in the early 1990s. Congress mandated that President Reagan create an independent commission to sort through the possibilities and provide recommendations. The National Commission on Space (NCOS) was launched officially on 29 March 1985 with the goal of blueprinting the next 20 years of the civilian space program. The NCOS was to present results to the White House and Congress following a one-year study.

Reagan tapped Tom Paine, NASA Administrator from 1968 to 1970, to head the NCOS. Fourteen commissioners joined Paine. They included such luminaries as Neil Armstrong, the first human to walk on the Moon; Chuck Yeager, the first human to break the sound barrier; former United Nations Ambassador Jeane Kirkpatrick; Space Shuttle astronaut Kathy Sullivan; and retired Air Force General Bernard Schriever. Laurel Wilkening, a planetary scientist and Vice Provost of the University of Arizona, was Vice Chair.

Non-voting NCOS members included representatives from both parties of Congress and the Departments of State, Commerce, Agriculture, and Transportation, as well as the National Science Foundation and the White House Office of Science and Technology Policy. In addition to the inputs provided by its members, the NCOS held public forums and solicited written contributions from academe, business, and the general public.

The result was Pioneering the Space Frontier, a glossy report billed as "an exciting vision of our next fifty years in space."[2] It was the first in a series of high-profile space reports produced in the Reagan/Bush years.

Paine's attitude had not changed much since his time as NASA Administrator. He still saw it as his job to challenge Americans to take on the solar system. The NCOS report's expansive vision bore Paine's unmistakable stamp; in fact, it bore a resemblance to Paine's timeline from the Case for Mars II. Paine looked to an expanding 21st-century economy with "free societies on new worlds" and "American leadership on the new frontier."

Events caught up with the NCOS exercise, however. On the chilly Florida morning of 28 January 1986, with much of the Commission's work complete, Space Shuttle Challenger exploded 73 seconds into mission STS-51L, killing seven astronauts and grounding the remaining three Shuttle orbiters. The immediate cause of the accident was failure of a seal in one of the Shuttle's twin SRBs.

The Challenger accident threw the giddy optimism of Paine's NCOS report into sharp relief. It was a wake-up call. The Space Shuttle would not, could not, provide the kind of low-cost, routine space access envisioned during the 1970s. "The myth of an economic Shuttle" was laid bare.[3] The basic tool for establishing space infrastructure was found wanting, forcing many of the infrastructure elements envisioned by Mars planners in the early 1980s into some indefinite post-Shuttle future.

The accident contributed to NASA's decision to redesign the Space Station in mid-1986. After more than two years of studies, NASA had unveiled its station design in early 1986. Called the Dual Keel, it was primarily a space laboratory, but included a large rectangular truss which might eventually hold hangars, assembly equipment, and a propellant depot for Moon and Mars spacecraft. The rectangular truss was, however, adopted primarily to provide attachment points for anticipated user payloads, with space-facing payloads on the top and Earth-facing payloads on the bottom.[4]

Following Challenger, the Dual Keel design came to be seen as too ambitious. The rectangular truss was deferred to a future Phase II of station assembly. Phase I would consist of a single straight truss holding solar

arrays and a cluster of pressurized modules. Designers sought, however, to include software "scars" and hardware "hooks" in the Phase I design to permit eventual expansion to the full Dual Keel configuration.[5]

From the Mars explorers' point of view, the accident demonstrated that the Space Shuttle could not be used to launch Mars ships. It had been felt by many before Challenger that the Shuttle would have to be supplemented by a heavy-lift rocket if piloted flight beyond low-Earth orbit was to be a credible NASA goal, but it became patently obvious to most everyone on that cold day in January 1986.

Paine's report was crammed full of new vehicles and interplanetary infrastructure based largely on SAIC and Eagle Engineering studies. The NCOS called for new cargo and passenger launch vehicles to replace the Space Shuttle by 1999 and 2000, respectively. These were components of a "Highway to Space" that would include the initial Earth-orbital Space Station (1992), a space-based OTV (1998), and an initial Earth-orbital spaceport (1998). This segued into a "Bridge Between Worlds" that would include a single-stage-to-orbit space plane, a Moon base with facilities for mining lunar oxygen, cyclers and Lagrange point stations, nuclear-electric space freighters, and, by 2026, a Mars base resembling the one put forward at the Case for Mars II workshop (1984).

The NCOS program would cost about $700 billion between 1995 and 2020. This cost would, Paine wrote, be paid through increases in NASA funding keeping pace with projected increases in U.S. GNP of 2.4 percent per year. NASA funding in 1986 was about $10 billion, or less than 1 percent of GNP. According to the report, if NASA funding remained near 1 percent of GNP, it would increase to $20 billion in 2000 and to $35 billion in 2020. For the near-term, the report urged that the new technology development share of NASA's budget be raised from 2 percent to 6 percent.

The NCOS turned over its report to the Reagan White House in March 1986, two months after the Challenger accident. Paine went public with the report even before presenting it to the White House by giving a draft to Aviation Week & Space Technology magazine.[6] Unusually, the report was also published as a trade paperback and sold in bookshops.

Paine presented the NCOS report formally to President Reagan and the Senate and House Space Committees on 22 July 1986. It urged the White House to direct the NASA Administrator to respond by 31 December 1986 with general long-range and specific short-range implementation plans. Paine summed up the NCOS report the next day at the NASA Mars Conference, underway at the National Academy of Sciences to commemorate the tenth anniversary of Viking 1's landing. He told the assembled scientists and engineers that Reagan had assured him that the Commission's recommendations would be accepted.[7]

The report's conclusion assumed—correctly—that Paine's vision would be seen as grandiose, and took pains to defend it. As he had done in the 1969 Space Task Group report, Paine described the technological progress made in the past in an effort to demonstrate the progress that could be made in coming decades.

> Is our expansive view of America's future realistic? Are the technical advances we project achievable? Will people accept the risks and discomforts to work on other worlds? We believe that the answer to all three questions is "Yes!" Few Americans in the early days of the Air Age ever expected to fly the Atlantic. . . yet nearly 75,000 people now fly the Atlantic daily . . . . It is equally difficult for Americans this early in the Space Age to visualize the 21st-century technologies that will enable the average citizen to soar into orbit at low cost, to fly to new worlds beyond Earth, and to work and live on the space frontier in closed-ecology biospheres using robotically-processed local resources . . . . We should . . . emphasize that: The Commission is not prophesying; it is describing what the United States can make happen through vigorous leadership in pioneering the space frontier.[8]

The NCOS plan was not so much a plan for guiding NASA's future as an evocation of the pioneering spirit which Paine felt was flagging in 20th-century Americans. The romantic attraction to pioneering has in fact always been a rare thing. Those afflicted by it frequently feel great zeal, which blinds them to the fact that they are rarities—that others, while frequently

sympathetic to their vision, do not place as high a priority as they do upon making it real.

The NCOS report was not well received, primarily because the Challenger accident had made clear that NASA was in no position to tackle such an expansive, all-encompassing plan. But it was also seen as too general, with too many proposals. In late August 1986, former Presidential Science Advisor George Keyworth, who had been a non-voting NCOS member, said the report had forfeited impact by putting forward proposals "that stretch all the way from China to New York."[9] At a time when NASA was grounded and struggling to adapt its programs to the Shuttle's revealed shortcomings, the NCOS discussed topics as wide-ranging as self-replicating space factories, the International Space Year, and the Big Bang. Arguably, all were important to NASA's future missions, but presenting them in a single report merely made the view forward seem more clouded.

The Reagan White House quietly shelved the NCOS report; as Paine complained in an Aviation Week & Space Technology opinion piece in September 1987, "[T]he mandated presidential response to the commission has been delayed."[10] It is hard to fault the spirit of Paine's report. But the Agency's challenge in 1986 was to recover from the Challenger accident. If a plan for NASA's future in space was to be drawn up, it would have to attempt to take into account the realities of U.S. space flight in the mid-1980s. Such a plan was not long in coming, thanks to heightened public interest in NASA's activities following the Challenger accident, widespread concern that NASA had no long-term direction, and on-going efforts by Mars advocates.

The Ride Report

Sally Ride was a member of the 1978 astronaut class, the first selected for Space Shuttle flights; in 1983 she became the first American woman in space. She flew on the Shuttle twice and sat on the Rogers Commission investigating the Challenger accident before James Fletcher, in his second stint as NASA Administrator, appointed her as his Special Assistant for Strategic Planning (18 August 1986) and charged her with preparing a new blueprint for NASA's future. She was assisted by a 10-member panel and a small staff. The result of her 11-month study was a slim report entitled Leadership and America's Future in Space.

Aviation Week & Space Technology reported initial resistance inside NASA to releasing Ride's report. The magazine quoted an unnamed NASA manager who said the agency was "afraid of being criticized by the Office of Management and Budget." The report's frank tone may also have contributed to NASA's reluctance. In the end, Agency managers relented and published 2,000 copies in August 1987.[11]

On 22 July 1987, Ride testified to the House Subcommittee on Space Science and Applications. She told the Subcommittee that the "civilian space program faces a dilemma, aspiring toward the visions of the National Commission on Space, but faced with the realities of the Rogers Commission report."[12] Ride explained that she had attempted to reconcile "two fundamental, potentially inconsistent views." "Many people," she said, believed that "NASA should adopt a major visionary goal. They argue that this would galvanize support, focus NASA programs, and generate excitement." Others, Ride stated, maintained that NASA was "already overcommitted for the 1990s"—that it would be "struggling to operate the Space Shuttle and build the Space Station, and could not handle another major program."[13]

While Paine's NCOS report urged rapid implementation of an expansive vision, Ride's report outlined four more limited leadership initiatives "as a basis for discussion." She explained that her report was "not intended to culminate in a selection of one initiative and elimination of the other three, but rather to provide concrete examples which could catalyze and focus the discussion of the goals and objectives of the civil space program, and of NASA efforts required to pursue them."[14]

Ride thus deviated from the pattern Paine had established in the STG report and continued in the NCOS report; she did not propose a single "master plan." In her congressional testimony she explained her guiding principle: "goals must be carefully chosen to be consistent with the national interest and . . . NASA capabilities. It is not appropriate for NASA to set the goals of the civilian space program. But NASA should lead the discussion . . . , present options, and be prepared to make recommendations."[15] Ride's four Leadership Initiatives were as follows:

- Mission to Planet Earth: "a program that would use the perspective afforded from space to study . . . our home planet on a global scale."

- Solar system exploration using robots.

- Outpost on the Moon: an ". . . evolutionary, not revolutionary . . . program that would build on. . . the legacy of the Apollo Program . . . to continue exploration, to establish a permanent scientific outpost, and to begin prospecting the Moon's resources."

- Humans to Mars: "a series of round trips to land on the surface of Mars, leading to the eventual establishment of a permanent base." The Mars mission, Ride asserted, should "not be another Apollo—a one-shot foray or a political stunt."[16]

None of Ride's four initiatives necessarily depended on the others. Her "attempt to crystallize our vision of the space program in the year 2000" in fact represented a partial break from the space station-Moon-Mars progression that had typified most NASA advanced planning.[17] Ride's approach caused confusion. For example, Aviation Week & Space Technology magazine and many newspapers incorrectly reported that she had called for a Moon base as a precursor to a piloted Mars mission. In fact, her report stated that the Moon was "not absolutely necessary" as a "stepping stone" to Mars.[18, 19]

This reflected the influence of a NASA Advisory Council Task Force led by Apollo 11 astronaut Michael Collins. "I think it is a mistake to consider the [M]oon as a necessary stepping stone to Mars," Collins told Aviation Week & Space Technology in July. "It will not get support politically, or from the U.S. public, which thinks we've 'already done the [M]oon.'"[20] Ride personally favored the Moon-Mars progression, however; she wrote that it "certainly makes sense to gain experience, expertise, and confidence near Earth first."[21]

In common with the station-Moon-Mars progression, Ride's initiatives all included NASA's Space Station. This was a ground rule established by Fletcher—not surprisingly, since the Space Station Program had begun only three years before and was fiercely defended by NASA.[22] As explained earlier, in Challenger's aftermath, Space Station had become a two-phase program. Ride pointed out that a decision on NASA's future course would impact the Phase II configuration. She wrote that a "key question for the not-too-distant future is 'how should the Space Station evolve?'" and noted that Space Station evolution workshops in 1985 and 1986 had found that "a laboratory in space featuring long-term access to the microgravity environment might not be compatible with an operational assembly and checkout facility [of the type envisioned to support Moon and Mars exploration], as construction operations could disturb the scientific environment."[23]

Like the NCOS report, Ride's report called for NASA to increase its efforts to develop advanced space technology for exploration missions. She told the House Subcommittee that "the future of our space program lies in careful selection and dedicated pursuit of a coherent civil space strategy, and the health of our current space program lies in determined development of technologies required to implement that strategy."[24] Ride's report recommended Project Pathfinder, a program to develop technologies that had been identified by a panel of NASA engineers as crucial to future space programs. These included aerobraking, automated rendezvous and docking, and advanced chemical propulsion. "Until advanced technology programs like Pathfinder are initiated" wrote Ride, "the exciting goals of human exploration will always remain 10 to 20 years in the future."[25]

On 1 June 1987, Fletcher had created the NASA Headquarters Office of Exploration, with Ride as Acting Assistant Administrator for Exploration, responsible for coordinating missions to "expand the human presence beyond Earth." In explaining this move, Fletcher said that "[t]here are considerable—even urgent—demands for a major initiative to reenergize America's space program . . . this office is a step in responding to that demand."[26] In her report, Ride wrote that "[e]stablishment of the Office of Exploration was an important first step. Adequate support of the Office will be equally important." She noted that there was "some concern that the office was created only to placate critics, not to provide a serious focus for exploration. Studies relating to human exploration of the Moon or Mars currently command only about 0.03 percent of NASA's budget . . . this is not enough . . . ."[27]

Ride targeted the first Mars landing for 2005. Her report pointed out, however, that "NASA's available resources were strained to the limit flying nine Shuttle flights in one year." "This suggests," it concluded, "that we should . . . proceed at a more deliberate (but still aggressive) pace, and allow the first human landing to

occur in 2010. This spreads the investment over a longer period."[28]

SAIC began designing the Mars mission in Ride's report in January 1987 and completed its study for the NASA Headquarters Office of Exploration in November 1987.[29] John Niehoff, the study's Principal Investigator, was the "Humans to Mars Initiative Advocate" for the Ride Report. He had also worked on The Planetary Society's 1984 Mars study (see Chapter 7). Niehoff's team proposed a three-part Mars exploration strategy:

- 1990s: Robotic missions, including a global mapper and a sample-return mission, would "address key questions about exobiology and obtain ground-truth engineering data." This period would also see research aboard the Space Station into the effects of prolonged weightlessness on astronaut health, and development of "heavy-lift launch vehicles, high energy orbital transfer stages, and large-scale aerobrakes."

- 2000s: Piloted missions with round-trip times of about one year, stay-times near Mars of 30 to 45 days, and Mars surface excursions of 10 to 20 days were the primary emphasis of the SAIC study. These missions would explore potential outpost sites and build up interplanetary flight experience. The one-year trip-time was designed to reduce crew exposure to weightlessness and radiation.

- After 2010: "A piloted base on Mars . . . a great national adventure which would require our commitment to an enduring goal and its supporting science, technology, and infrastructure for many decades."[30]

A large amount of energy would be required to get the ship to Mars and back in about a year, which in turn would demand a prohibitively large amount of propellant. With an intent to reduce the number of heavy-lift rocket launches needed to mount the expedition, SAIC adopted a split/sprint mission mode based on a design developed by students from the University of Texas and Texas A&M University. This had a one-way, automated cargo vehicle leaving Earth ahead of the piloted sprint

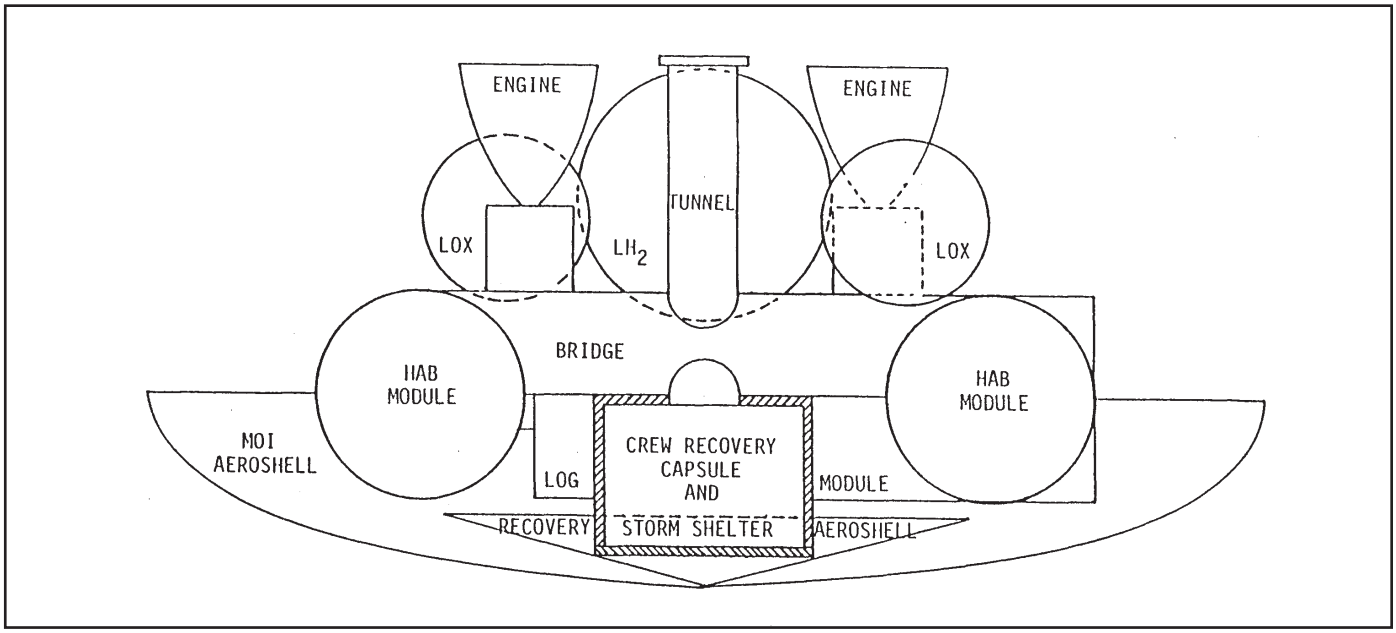

Figure 21—Science Applications International Corporation developed its Mars mission plan for NASA during 1987. The piloted spacecraft (shown here in cutaway) would reach Mars with empty propellant tanks and dock with a waiting automated cargo ship to fill up for the trip home—a controversial departure from past Mars plans. (Piloted Sprint Missions to Mars, Report No. SAIC-87/1908, Study No. 1-120-449-M26, Science Applications International Corporation, Schaumburg, Illinois, November 1987, p. 9.)

vehicle on a low-energy trajectory. The cargo vehicle would carry Earth-return propellants for the piloted ship. To some this was worrisome—if the sprint spacecraft could not rendezvous and dock with the cargo vehicle, the crew would become stranded at Mars with no propellants for return to Earth.[31]

In phase 1 of SAIC's four-phase Mars mission, seven heavy-lift rockets would launch parts for the cargo

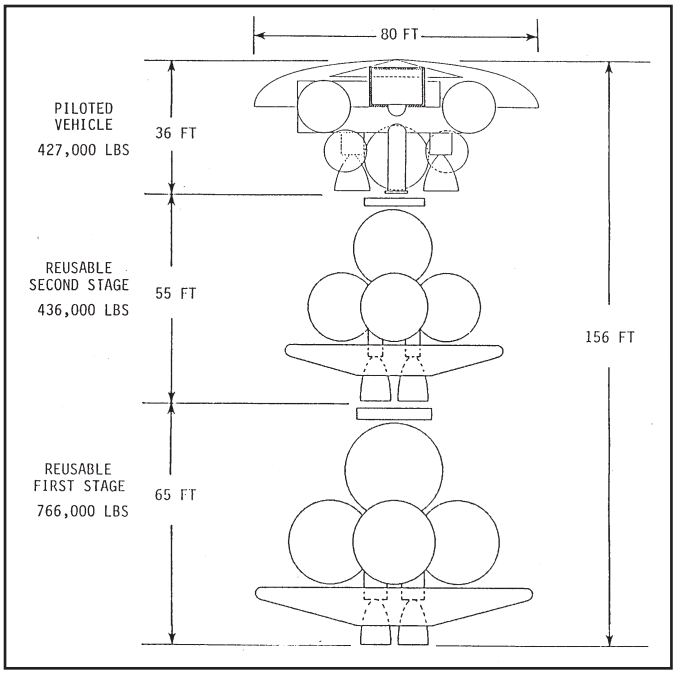

Figure 22—Two Orbital Transfer Vehicles would push the Science Applications International Corporation piloted Mars ship out of Earth orbit. The company assumed that Orbital Transfer Vehicles would be built for non-Mars programs in time to support its expedition, slated to reach Mars in 2005. (Piloted Sprint Missions to Mars, Report No. SAIC-87/1908, Study No. 1-120-449-M26, Science Applications International Corporation, Schaumburg, Illinois, November 1987, p. 27.)

vehicle and a reusable OTV, propellants, and cargo into orbit near the Space Station. The OTV and cargo vehicle together would measure 30.5 meters long and weigh 58.8 metric tons fully fueled. In addition to Earth-return propellants for the piloted sprint vehicle, the 23.9-metric-ton cargo vehicle would carry the Mars lander and scientific equipment.

According to SAIC's timetable, on 9 June 2003 the OTV would push the cargo ship onto a minimum-energy Mars trajectory, then separate and aerobrake in Earth's atmosphere to return to the Space Station for reuse. The cargo ship would aerobrake into Mars orbit on 29 December 2003.

Phase 2 would start one year after phase 1. Eight heavy-lift launch vehicles would place propellants and components for the piloted sprint vehicle and a second OTV into Earth orbit near the space station. The OTV used to launch the cargo vehicle would be combined with the new OTV and the sprint vehicle to create a 73.9-metric-ton, 47.5-meter-long stack. The sprint vehicle alone would weigh 19.4 metric tons fully fueled.

SAIC's sprint vehicle design was based on a 24.4-meter-diameter saucer-shaped aerobrake. Four pressurized living modules housing six explorers nestled within the saucer. Twin restartable rocket engines drew propellant from spherical liquid hydrogen and liquid oxygen tanks mounted on top of the living modules. A docking tunnel started at the conical ERV mounted on the aerobrake's inner surface, passed through a "bridge" tunnel linking the modules, and protruded beyond the twin engine bells. The thick-walled ERV doubled as the ship's radiation shelter.

The sprint vehicle would leave Earth on 21 November 2004. The first OTV would accelerate the sprint ship and second OTV, separate, and aerobrake in Earth's atmosphere for return to the Space Station. The second OTV would also accelerate the sprint ship and return to the station. The OTVs could be reused for future sprint/split Mars expeditions. The sprint vehicle would then fire its own rockets briefly to complete insertion onto a low-energy trans-Mars trajectory. A six-month trip to Mars would be possible, but Niehoff's team advocated an eight-month trajectory that would allow a Mars flyby and abort to Earth if the cargo ship waiting in Mars orbit with the piloted ship's Earth-return propellant failed during the crew's flight to Mars. An abort would have the Mars crew back on Earth on 5 January 2006. Assuming no abort became necessary, the sprint ship would aerobrake into Mars orbit on 3 July 2005.[32]

In phase 3, the sprint spacecraft would dock with the cargo ship in Mars orbit. Three astronauts would board the two-stage lander, undock, and land on Mars for 10 to 20 days. The crew in orbit, meanwhile, would perform scientific research, eject the sprint ship's Mars

aerobrake, and transfer Earth-return propellant from the cargo vehicle. The lander crew would then return to Mars orbit in the ascent stage. On 2 August 2005, the sprint vehicle would fire its engines for a high-energy five-month sprint return to Earth.

Phase 4 would begin a few days before Earth arrival (15 January 2006 for a nominal mission). The astronauts would enter the ERV and separate from the sprint spacecraft. The ERV would aerobrake into Earth orbit while the abandoned sprint ship entered solar orbit. A station-based OTV would recover the ERV; then a Space Shuttle would return the crew to Earth.

On 26 May 1987, NASA had announced that, after finishing her study, Ride would leave NASA to become Science Fellow in the Stanford University Center for International Security and Arms Control.[33] In August, John Aaron took over the Office of Exploration. Studies begun in January 1987 to support the Ride report became the basis for piloted exploration "case studies" in FY 1988. These examined a mission to Phobos, a Mars landing mission, a lunar observatory, and a lunar outpost-to-Mars evolutionary program. All commenced with assembly of the Phase I Space Station.[34]

Martin Marietta became the Office of Exploration's de facto exploration study contractor. On 15 May 1987, NASA Marshall had awarded the $1.4-million Mars Transportation and Facility Infrastructure Study contract to the company, with SAIC in "an important teaming role," and Life Systems and Eagle Engineering as subcontractors.[35] The initial contract focus was in keeping with Marshall's propulsion emphasis; as in the EMPIRE days, the Huntsville Center anticipated developing new rockets for Mars.

However, because it was the only Mars-related NASA contract when the Office of Exploration was established, it became a mechanism for funding more general Mars-related studies. The contract, which lasted until 30 April 1990, underwent 500 percent growth as new study areas were grafted on. By the time it ended, Martin Marietta had generated nearly 3,000 pages of reports. Though Martin Marietta lost the contract to Boeing when it was recompeted in late 1989, it served to create an institutional expertise base for Martin Marietta studies during the Space Exploration Initiative (1989–93).[36]

Opposition

NASA started as an instrument of Cold War competition with the Soviet Union. In the 1970s, having won the race to the Moon, NASA was partly reapplied as an instrument of international détente. The 1972 Space Cooperation Agreement called for the Apollo-Soyuz Test Project and other cooperative space activities. A Soviet Soyuz spacecraft docked in Earth orbit with America's last Apollo spacecraft in July 1975. When the agreement was renewed in 1977, it included plans for a U. S. Shuttle docking with a Soviet Salyut space station. By 1980, however, the Soviet invasion of Afghanistan had undermined détente, ending virtually all talks on piloted space cooperation.[37]

In 1982, the Reagan White House let the Space Cooperation Agreement lapse to protest continued Soviet involvement in Afghanistan and martial law in Poland. In the first major step toward renewed cooperation, Senator Spark Matsunaga (Democrat-Hawaii) sponsored legislation calling for renewal of the Space Cooperation Agreement. Congress passed the Matsunaga resolution, and President Reagan signed it into law in October 1984.[38]

On 11 March 1985, Mikhail Gorbachev became the Soviet Union's new leader. He set about implementing a raft of new reform policies. Making them work meant diverting resources from Cold War confrontation to domestic production. A charismatic leader representing a new generation of Soviet politicians, he encouraged many in the West by working to thaw relations with the United States.

Against this background, The Planetary Society partnered with the influential AIAA to hold the Steps to Mars conference in Washington, DC, on the tenth anniversary of Apollo-Soyuz. NASA Administrator James Beggs was on hand to hear Carl Sagan and others promote a joint United States-Soviet Mars expedition.

Sally Ride had written of the difficulty of reconciling visionary and conservative space goals. The Planetary Society Mars proposal fell into the former category. Unlike some visionary goals, however, it proposed giving Mars exploration a political purpose, just as Apollo lunar exploration had a political function in the 1960s. Beggs endorsed U.S.-Soviet space cooperation, but cau-

tioned that "when you get down to the nitty-gritty of working out details, it's not so easy."[39]

The U.S. and the Soviet Union renegotiated a new Space Cooperation Agreement in November 1986. Unlike its predecessors in 1972 and 1977, it contained no provision for cooperative piloted missions. A month later, Sagan published a prescient editorial in Aviation Week & Space Technology. The Cornell University astronomer asked, "What if sometime in the next few years a general strategic settlement with the Soviet Union is achieved . . . ? What if the level of military procurement . . . began to decline?" Sagan believed that "[I]t [was] now feasible to initiate a systematic program of exploration and discovery on the planet Mars . . . culminating in the first human footfalls on another planet" at a cost "no greater than a major strategic weapons system, and if shared by two or more nations, still less." He added that Mars was "a human adventure of high order, able to excite and inspire the most promising young people."[40]

The U.S. and the Soviet Union renewed the Space Cooperation Agreement in April 1987. Emboldened, The Planetary Society circulated The Mars Declaration widely in late 1987. Declaration signatories included former NASA Administrators and Apollo-era officials, astronauts, Nobel laureates, actors, authors, politicians, university presidents and chancellors, professors, pundits, composers, artists, and others. It called for a joint U.S.-Soviet expedition to serve as a model for superpower cooperation in tackling problems on Earth, and it called Mars a "scientific bonanza" that could provide "a coherent focus and sense of purpose to a dispirited NASA" in the wake of the Challenger accident.[41]

Mars, the Declaration continued, would give the U.S. Space Station a "crisp and unambiguous purpose" as an assembly point for Mars ships and as a laboratory for research into long-duration space flight. Planetary Society vice president and former JPL director Bruce Murray was outspoken on this point. Reiterating what George Low and Nixon's PSAC had stated in the early 1970s, he told the AIAA in January 1988 that "the principal logic for the [S]tation is in the context of a Mars goal."[42]

Meanwhile, the "future indicators" the CIA had listed for Harrison Schmitt in 1985 had begun to occur. On 15 May 1987, the Soviet Union launched the first Energia rocket, the most powerful to leave Earth since the U.S. scrapped the Saturn V. Energia functioned perfectly, though its 80-metric-ton Polyus payload failed to achieve orbit. On 21 December 1988, cosmonauts Vladimir Titov and Musa Manarov returned to Earth after a record 365-day stay aboard the Mir space station—long enough to have performed a one-year piloted Mars flyby.

Mikhail Gorbachev first publicly called for a joint U.S.-Soviet Mars mission as Titov and Manarov boarded Mir in December 1987. He told the Washington Post and Newsweek before the May 1988 Moscow summit that he would "offer to President Reagan cooperation in the organization of a joint flight to Mars. That would be worthy of the Soviet and American people."[43] On 24 May 1988, Pravda carried an article by Soviet space flight leaders Yuri Semyonov, Leonid Gorshkov, and Vladimir Glushko calling for a joint Mars mission.[44] Little progress was made toward Mars at the Moscow Summit, but major strides were taken toward ending the Cold War. Time magazine's cover for 18 July 1988 showed a Viking photo of Mars with U.S. and Soviet flags and the legend "Onward to Mars."

Halfway through Titov and Manarov's year-long stay on Mir (7 July 1988), the Soviet Phobos 1 Mars probe lifted off from Baikonur Cosmodrome on a Proton rocket. Phobos 2 lifted off on 12 July. The twin probes featured involvement by more than a dozen countries, including the United States. They were designed to orbit Mars and explore their namesake moon Phobos. After rendezvous with the pockmarked little moon, they would drop a "hopper" rover and a small lander.

In retrospect, however, the probes were the Soviet Mars program in miniature—they got off to a triumphant start, then sputtered. On 31 August 1988, operators at the Flight Control Center in Kaliningrad, near Moscow, sent the Phobos 1 Mars spacecraft an erroneous radio command that caused it to lose attitude control and turn its solar arrays away from the Sun. Starved for power, Phobos 1 failed just two months into its 200-day flight to Mars. Phobos 2 reached Mars orbit on 29 January 1989. The spacecraft returned useful data on Mars and Phobos; however, it failed in late March as it neared the long-anticipated Phobos rendezvous.

At 6.5 metric tons each, the Phobos probes were the heaviest Mars probes ever to leave Earth orbit. They

took advantage of the minimum-energy launch opportunity associated with the September 1988 Mars opposition, the best since 1971.

Mars glowed bright orange-red in Earth's skies as the Space Shuttle Discovery was rolled to its Florida launch pad for the first Shuttle flight since Challenger. On 29 September 1988, as Earth overtook Mars in its orbit and pulled ahead, Discovery lifted off on the 26th flight of the Space Shuttle Program. The four-day, five-crew STS-26 flight ended a 33-month hiatus in U.S. piloted space flight—the longest since the 1975-1981 Shuttle development period. By the time STS-27 launched in December, Mars was fading fast and the U.S. Space Shuttle was no longer the world's only reusable piloted spacecraft. The second Energia rocket had launched on 15 November 1988 with a Buran shuttle on its back for an unpiloted test flight.

The Mars planning community, though still small and with few resources, was in ferment. New leadership in the Soviet Union, the expanding Soviet space program, and the thawing of U.S.-Soviet relations, coupled with America's return to piloted space flight and growing public awareness of Mars, seemed to create an opportunity. As will be seen in the next chapter, newly elected President George Bush would take up the mantle of President Kennedy and declare for Mars. Though a failure, his initiative would not be without significant results.